

The Construction of a Publicly Funded Teacher Training System Based on the Empirical Modal Analysis Method

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Abstract. The OBE concept insists on the development of students' abilities as the main focus and provides new ideas for the cultivation of publicly funded teacher training professionals. This paper firstly analyzes and defines the OBE concept, modal analysis and Jacobi matrix and clarifies the use of empirical modal analysis in the OBE concept. Secondly, it clarifies the relationship between teaching and students based on the four stages of the teaching model design of the OBE concept. Finally, the relationship between learning outcomes and graduation requirements of publicly funded teacher training students is evaluated in terms of the public teacher training system based on the test modal analysis method under the OBE concept. The mean scores of students under the old and new training systems were 72.41 and 88.72, respectively, with standard deviations of 18.0312 and 13.9142. Students' learning outcomes under the new training system improved significantly, and their GPAs increased. The scientific construction of the teacher training system based on the OBE concept can help improve the quality of teacher training and the quality of school operation, which is of great significance to the cultivation of professional talents.

1. Introduction

Publicly funded teacher-training students first appeared as free teacher-training students in teacher-training colleges and universities, and these students are exempted from tuition and accommodation fees and receive a certain living allowance. Accordingly, these students must fulfill the corresponding obligation that they will be assigned to teach in primary and secondary schools in their place of origin for 10 years after graduation [1–3]. In 2018, after the Ministry of Education summarized the advantages and shortcomings of free teacher training students in recent years, the number of years of teaching was shortened to 6 years [4]. In general, publicly funded teacher trainees are not very different from previous free teacher trainees, referring to teacher trainees who enjoy preferential policies but need to teach in the corresponding townships after graduation [5–7].

The literature [8] points out that the goal of the local publicly funded teacher education system is mainly aimed at supplementing and optimizing the quantity and quality of rural teachers. Its main means is to attract and train a large number of excellent teachers through the publicly funded teacher education system,

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to ensure the supply level of rural teachers, to promote the balanced allocation of urban and rural teacher resources, and to be a targeted supplemental means for the expected quality teachers in rural schools [9, 10]. Deficiencies in institutional design, imperfect supporting systems, unscientific enrollment systems and lack of competition mechanisms among institutions undertaking training tasks have led to multiple problems in the current training of local publicly funded teacher trainees [11–13]. The literature [14, 15] improved the institutional design, established a dynamic evaluation and entry and exit mechanism for institutions undertaking training tasks, and suggested that improving the implementation environment and conditions of the local publicly funded teacher training system is the basic path to policy optimization. The literature [16] points out that as of 2021, local teacher training colleges in 28 provinces have started to enroll publicly funded teacher trainees. The literature [17] argues that publicly funded education through teacher training students provides more solutions to the plight of backward basic education in local remote areas. Literature [18, 19] teacher education has produced more excellent primary and secondary school teachers for remote areas and provided more solutions to the problem of lack of teachers at the grassroots level in backward and remote areas.

Pradhan, D. stated that the advantages of the OBE philosophy in the field of education are that it helps students to be more informed and creative and contributes to their career development [20]. Katherine sees the OBE philosophy as adhering to a learner-centered approach to curriculum design and instruction that emphasizes the learner's perception and performance and how to adapt to life outside of formal education [21]. Kumbhar believes that the traditional education system is losing its importance and that the goal of the college is to develop students' coping skills and prepare them to adapt and become familiar with the OBE philosophy [22].

This paper uses OBE as a guide to constructing a training system for publicly funded teacher-training students mainly from the learning outcomes of students, focusing on identifying the objectives, contents and structures of teacher-training professionals. It explores the publicly funded teacher training system constructed based on the empirical modal analysis method under the OBE concept and cultivates high-quality applied technical talents to meet the needs of the education industry, schools and society. Firstly, we analyze and define the OBE concept and modal analysis, select the Jacobi matrix, and briefly analyze the use of empirical modal analysis in the OBE concept. Secondly, the four phases of the OBE concept teaching model design are specifically analyzed, which are the definition learning phase, realization learning phase, evaluation learning phase and use learning phase. Finally, we construct a system for training publicly funded teacher trainees based on the test modal analysis method in the OBE concept. The graduation requirements and competency indicators of publicly funded teacher training students and the curriculum standards of each subject were established. The average scores of students in the two classes were compared and analyzed, and it was concluded that the training system based on the empirical modal analysis method under the OBE concept provides an effective platform for the cultivation of publicly funded teacher training professionals.

2. Modal Analysis Method

2.1. Modal analysis framework

According to the different means and methods of studying modal analysis, modal analysis is divided into theoretical modal analysis and experimental modal analysis. Theoretical modal analysis is based on linear vibration theory, and the study of excitation, system and response is divided into three models, i.e., physical parametric model, modal parametric model and non-parametric model.

Figure 1 shows the process of theoretical modal analysis, that is, the boundary conditions, geometry and material properties of the structure are determined first, and the mass distribution, stiffness distribution and damping distribution of the structure are represented by a mass matrix, stiffness matrix and damping matrix respectively, and then the modal parameters of the system are determined through calculation. The theoretical modal analysis mainly includes finite element modal analysis and analytical modal analysis.

Experimental modal analysis can be regarded as the inverse process of theoretical modal analysis. The excitation and response signals at certain points on the structure are measured, and then the data obtained

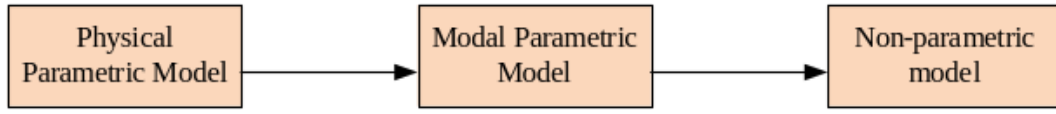


Figure 1: Theoretical modal analysis

from the measurements are calculated and converted into transfer functions, and then the measured transfer functions are analyzed to estimate the modal parameters. The experimental modal analysis is shown in Figure 2.

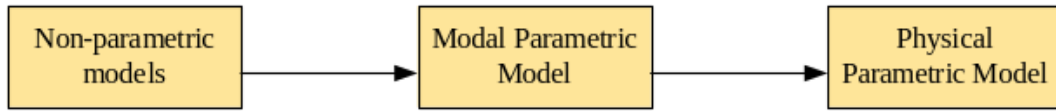


Figure 2: Experimental modal analysis

2.1.1. Theoretical modal analysis

(1) After the discretization of a structure in a physical coordinate system, its dynamic properties can be described by a matrix differential equation of order N :

$$\mathbf{M}\ddot{\mathbf{x}} + \mathbf{C}\dot{\mathbf{x}} + \mathbf{K}\mathbf{x} = \mathbf{f} \quad (1)$$

In equation (1), $\mathbf{M}$, $\mathbf{C}$ and $\mathbf{K}$ are the mass, damping and stiffness matrices of the structure, respectively. Usually, they are the N th order real symmetric matrix, $\ddot{\mathbf{x}}$, $\dot{\mathbf{x}}$, and $\mathbf{x}$ are the N -dimensional displacement, velocity and acceleration response vectors, and $\mathbf{f}$ is the N -dimensional excitation force vector.

Eq. (1) is the physical parameter model of the system, from which the inherent frequency matrix $\mathbf{\Omega}$ and the inherent vibration matrix $\mathbf{\Phi}$ of the system can be obtained as follows:

$$\mathbf{\Phi} : \mathbf{\Omega} = \text{diag}[\Omega_1 \ \Omega_2 \ \cdots \ \Omega_N]; \quad \mathbf{\Phi} = [\varphi_1 \ \varphi_2 \ \cdots \ \varphi_N] \quad (2)$$

(2) In the modal coordinate system, $\mathbf{\Phi}$ is taken as the basis vector matrix of the coordinate system space such that:

$$\mathbf{x} = \mathbf{\Phi}\mathbf{q} \quad (3)$$

Where $\mathbf{q}$ is the modal coordinate vector, and substituting equation (3) into equation (1) yields:

$$\mathbf{\Phi}^T \mathbf{M} \mathbf{\Phi} \ddot{\mathbf{q}} + \mathbf{\Phi}^T \mathbf{C} \mathbf{\Phi} \dot{\mathbf{q}} + \mathbf{\Phi}^T \mathbf{K} \mathbf{\Phi} \mathbf{q} = \mathbf{\Phi}^T \mathbf{f} \quad (4)$$

According to the orthogonality property of the column vector of the vibration matrix, we get the following:

$$\mathbf{\Phi}^T \mathbf{M} \mathbf{\Phi} = \mathbf{M}_r = \text{diag}[m_1 \ m_2 \ \cdots \ m_N] \quad (5)$$

$$\mathbf{\Phi}^T \mathbf{C} \mathbf{\Phi} = \mathbf{C}_r = \text{diag}[c_1 \ c_2 \ \cdots \ c_N] \quad (6)$$

$$\mathbf{\Phi}^T \mathbf{K} \mathbf{\Phi} = \mathbf{K}_r = \text{diag}[k_1 \ k_2 \ \cdots \ k_N] \quad (7)$$

Where $\text{diag}[\cdot]$ denotes the diagonal matrix, matrix $\mathbf{M}_r$ is called the generalized mass array, matrix $\mathbf{C}_r$ is called the generalized damping array, and matrix $\mathbf{K}_r$ is called the generalized stiffness array. Here it is assumed that the damping matrix $\mathbf{C}$ also satisfies the vibration orthogonality relation.

Substituting equations (5), (6) and (7) into equation (4) yields

$$\mathbf{M}_r \ddot{\mathbf{q}} + \mathbf{C}_r \dot{\mathbf{q}} + \mathbf{K}_r \mathbf{q} = \mathbf{\Phi}^T \mathbf{f} \quad (8)$$

Eq. (8) is the modal parameter model of the system.

(3) Let $\mathbf{f} = \mathbf{F}e^{j\omega t}$, $\mathbf{q} = \mathbf{Q}e^{j\omega t}$, $\mathbf{x} = \mathbf{X}e^{j\omega t}$ be substituted into equation (8) to obtain

$$\mathbf{X} = \mathbf{\Phi} (\mathbf{k}_r - \omega^2 \mathbf{m}_r + j\omega \mathbf{c}_r)^{-1} \mathbf{\Phi}^T \mathbf{F} = \mathbf{H}(\omega) \mathbf{F} \quad (9)$$

From this, we get the following:

$$\mathbf{H}(\omega) = \mathbf{\Phi} \text{diag} [h_1 \ h_2 \ \dots \ h_N] \mathbf{\Phi}^T \quad (10)$$

$h_r = [(k_r - \omega^2 m_r) + j\omega c_r]^{-1}$ in Eq. (10). Thus:

$$H_{ij}(\omega) = \sum_{r=1}^N \frac{\varphi_{ri} \varphi_{rj}}{(k_r - \omega^2 m_r) + j\omega c_r} = \sum_{r=1}^N \frac{\varphi_{ri} \varphi_{rj}}{m_r [(\omega_r^2 - \omega^2) + j2\xi_r \omega_r \omega]} \quad (11)$$

In the above equation, $\omega_r^2 = k_r/m_r$ is the r th-order intrinsic frequency, $\xi_r = c_r/(2m_r \omega_r)$ is the r th-order modal damping ratio, m_r , k_r and c_r are the r th-order modal mass, modal stiffness and modal damping, respectively. φ_{ri} is the r th-order modal vibration mode.

From equation (11), it can be seen that any row in the frequency response function matrix contains all the modal parameters of the system under test. Therefore, only one row or column of the frequency response function matrix needs to be measured and calculated, and then the frequency response function curve fitting is performed, followed by the identification of the modal parameters of the system under test using the modal parameter identification method, and then all the modal parameters of the object under test can be obtained.

2.1.2. Experimental modal analysis

The estimation of the frequency response function is a very important part of experimental modal analysis. It is connected to signal processing and parameter identification, and its estimation accuracy directly affects the results of modal parameter identification. Therefore, obtaining a high-quality frequency response function is the key to the modal test. However, there are always various kinds of interference noise in the measured input and output signals, which has a great impact on the accuracy of frequency response function estimation. In order to reduce the influence of noise and improve the accuracy of frequency response function estimation, a variety of frequency response function estimation forms is proposed.

Multiplying the two ends of Eq. (9) right by $\mathbf{F}^H(\omega)$ and $\mathbf{X}^H(\omega)$, respectively, and expressing each in terms of the one-sided power spectrum yields the following two equations:

$$H(\omega) = G_{fx}(\omega) G_{ff}^{-1}(\omega) \quad (12)$$

$$H(\omega) = G_{xx}(\omega) G_{xf}^{-1}(\omega) \quad (13)$$

In Eqs. (12) and (13), $G_{fx}(\omega)$ represents the mean value of the mutual power spectrum of the measured input signal and output signal, $G_{ff}(\omega)$ is the mean value of the self-power spectrum of the measured input signal, and $G_{xx}(\omega)$ is the mean value of the self-power spectrum of the measured output signal.

Taking the conjugate transpose of both ends of equation (9) and multiplying with equations (12) and (13), taking the time average and the ensemble average, we can obtain:

$$|H(\omega)|^2 = G_{xx}(\omega) G_{ff}^{-1}(\omega) \quad (14)$$

Eqs. (12), (13) and (14) are three commonly used forms of frequency response function estimation, called H_1 , H_2 and H_v estimates, respectively.

In the case of no noise pollution, these three estimation forms are equivalent. However, the actual measurement process due to the influence of noise, the three estimation forms of the frequency response function will appear certain differences. The input-output model of the system under the influence of noise is shown in Figure 3.

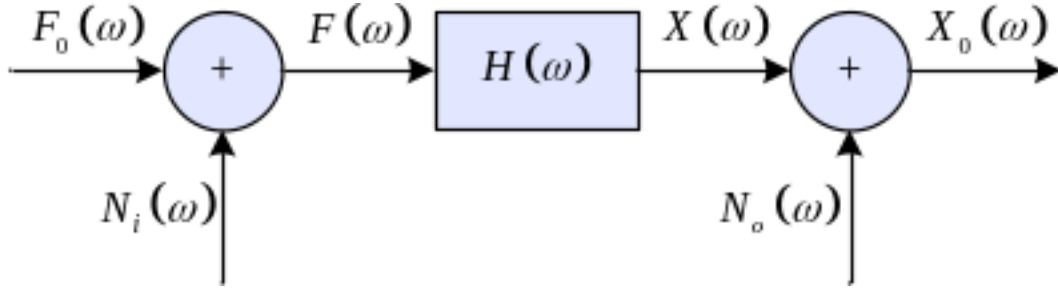


Figure 3: System input and output model

$F_0(\omega)$, $X_0(\omega)$, $N_i(\omega)$, and $N_o(\omega)$ represent the measured input signal, measured output signal, input noise signal, and output noise signal spectra, respectively, i.e., the respective Fourier transforms, and $H(\omega)$ is the frequency response function of the system to be estimated. The noise signal spectrum is brought into the three estimation equations of the frequency response function respectively, and the estimation equation of the frequency response function containing noise is obtained as follows:

$$H_1(\omega) = \frac{H(\omega)}{1 + \frac{G_{N_i N_i}(\omega)}{G_{FF}(\omega)}} \quad (15)$$

$$H_2(\omega) = H(\omega) \left(1 + \frac{G_{N_o N_o}(\omega)}{G_{X_0 X_0}(\omega)} \right) \quad (16)$$

$$H_v^2(\omega) = |H(\omega)|^2 \frac{1 + \frac{G_{N_o N_o}(\omega)}{G_{X_0 X_0}(\omega)}}{1 + \frac{G_{N_i N_i}(\omega)}{G_{FF}(\omega)}} \quad (17)$$

Comparing equations (15), (16) and (17), it can be seen that when there is noise interference in the input or output signal, $H_1(\omega) \leq |H(\omega)| \leq H_2(\omega)$. H_v is closer to the actual frequency response function than H_1 and H_2 . However, it can only get the amplitude estimation information of the frequency response function, can not get other information, so the application is less. H_1 is the actual frequency response function of the underestimation, suitable for estimation when the output signal noise is large. H_2 is the actual frequency response function of the over-estimation, applicable to the estimation of the input signal noise is large.

The estimated quality of the frequency response function can be characterized by the defined coherence function as follows:

$$\gamma^2(\omega) = \frac{|G_{fx}(\omega)|^2}{G_{ff}(\omega)G_{xx}(\omega)} = \frac{H_1(\omega)}{H_2(\omega)} \quad (18)$$

Eq. (18) reflects the coherence relationship between the excitation and response signals, which varies between 0 and 1. The size of the coherence function value is related to the signal strength and signal-to-noise ratio, in addition to the noise. Its size directly reflects the good or bad estimation of the frequency response function, if the measured response is completely generated by the excitation, then $\gamma^2(\omega) = 1$, the higher the accuracy of the frequency response function estimation. Conversely, if the response is completely uncorrelated with the excitation, then $\gamma^2(\omega) = 0$.

2.2. Jacobi matrix

The linearized power equation can be expressed in a matrix as follows:

$$J \begin{bmatrix} \Delta \theta \\ \Delta V \end{bmatrix} = \begin{bmatrix} \Delta P \\ \Delta Q \end{bmatrix} \quad (19)$$

Where ΔP is the nodal injected active power imbalance, ΔQ is the nodal injected reactive power imbalance, ΔV and $\Delta \theta$ are the nodal voltage and nodal voltage phase angle corrections, respectively, and J is the Jacobi matrix consisting of first-order partial derivatives. By converting the Jacobi matrix into a block matrix form by equivalence transformation, the power balance equation of the power system is

$$\begin{bmatrix} J_{P\theta} & J_{PV} \\ J_{Q\theta} & J_{QV} \end{bmatrix} \begin{bmatrix} \Delta \theta \\ \Delta V \end{bmatrix} = \begin{bmatrix} \Delta P \\ \Delta Q \end{bmatrix} \quad (20)$$

In the process of solving the power equation, our focus is mainly on the variation of reactive power. Therefore, it can be made $\Delta P = 0$. Equation (20) can then be written as

$$\Delta P = J_{P\theta}\Delta\theta + J_{PV}\Delta V = 0 \quad (21)$$

Solving for $\Delta\theta$ yields:

$$\Delta\theta = -J_{P\theta}^{-1}J_{PV}\Delta V \quad (22)$$

According to equation (19) and equation (21), we can obtain ΔQ as:

$$\Delta Q = [J_{QV} - J_{Q\theta}J_{P\theta}^{-1}J_{PV}] \Delta V = J_R \Delta V \quad (23)$$

This leads to the following equation:

$$\Delta V = J_R^{-1} \Delta Q \quad (24)$$

For with equation (24), according to the Schur formula for the chunking matrix, if $\|J_{P\theta}\| \neq 0$, then:

$$\|J\| = \|J_{P\theta}\| \cdot \|J_{QV} - J_{Q\theta}J_{P\theta}^{-1}J_{PV}\| = \|J_{P\theta}\| \cdot \|J_R\| \quad (25)$$

The above equation shows that the singularities of the Jacobi matrix of the system are related to $J_{P\theta}$ and J_R . If the singularity of the Jacobi matrix is caused by the singularity of $J_{P\theta}$, it corresponds to the static instability of the power system in terms of power angle, while the singularity of J_R represents the static instability of the power system in terms of voltage.

3. Construction of Training System Based on Empirical Modal Analysis Method under OBE Concept

3.1. OBE Concept

The OBE concept emphasizes the design of key teaching resources and the rational arrangement of teaching time around learning outputs and places great emphasis on the actual needs of talents required by society. The final learning outcomes that students achieve through learning are the goals of OBE-guided instructional design and implementation. The learning outcomes mentioned here are the maximum capabilities that learners can achieve after a certain stage of learning and the final learning outcomes.

The OBE concept has the following characteristics:

1. Outcomes are the knowledge and competencies that students internalize deep in their minds, not just what they believe, feel, remember, know, and understand.
2. The OBE philosophy of pursuing “end results” does not mean disregarding the stages of the learning process, but rather that teachers design the curriculum according to reverse design principles based on the intended end learning outputs.

OBE has the following implementation principles: reverse design around the expected output, with a clear focus on the final output of the learner. High expectations for student success, expanding opportunities for student success and providing assistance.

The four steps for implementing OBE are shown in Figure 4. The four steps of implementing OBE define learning outputs, achieve learning outputs, evaluate learning outputs, and use learning outputs.

Implications of the OBE concept for this study:

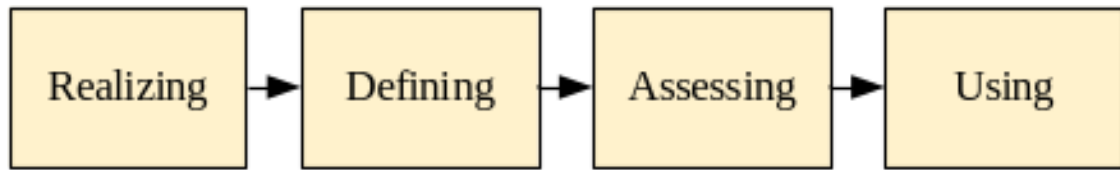


Figure 4: Four steps to implement OBE

1. Teachers should clarify the expected output that students should achieve when designing instruction and carefully organize learning resources around the expected output, both inside and outside the classroom, online and offline.
2. OBE advocates student-centeredness, and teachers should use a variety of teaching methods, teaching strategies, and assessment tools to accommodate the diversity of students.
3. Through learning, students can clearly know what they can do, not just what they know, and this feature can greatly stimulate students' interest in learning and enhance their self-confidence.
4. The implementation of the OBE concept allows students to expand their problem-solving skills from solving closed problems to solving open problems. This requires teachers to carefully organize subject-related open-ended problem resources.
5. The OBE concept and interrogative thinking are both "student-centered", focusing on the role of students' main body and cultivating students' problem awareness and thinking skills, which are inherently compatible with teaching.

3.2. Teaching Model of the OBE Concept

The most important thing for the construction of a curriculum system based on the OBE concept is to clarify the relationship between teaching and students first so as to design a curriculum system that is different from the traditional curriculum system, has practical application and is worth promoting. The teaching model of the OBE concept is shown in Figure 5.

3.3. Design of Teaching Model Based on Empirical Modal Analysis Method under OBE Concept

3.3.1. Defining learning output stages

Define the learning output stage as the stage where multiple needs are coordinated and matched with each other. The instructional design based on the OBE concept is shown in Figure 6. As the first stage of the model, the first step is to define the current outcome goals and implement them into specific courses, which is the key aspect of this stage. The outcome goals must be divided with a focus on social needs, and the outcome goals are decomposed into competency index points and correspond to specific projects to form a project-based teaching activity matrix. Reverse the design of the teaching content based on this matrix to ensure that the content here is relevant and becomes, indeed, effective for the students, aided by the learning environment and learning resources.

1. Social demand refers to the requirements of society for the ability of job seekers in various aspects, including knowledge, skills, moral quality, etc. Therefore, cultivating high-quality talents needs to start from the perspective of society, accurately understand the requirements of target positions for talents, understand the employment situation of today's society, and social demand analysis provides the basis and reference for the goal setting of the course.
2. Learning outcome goals are knowledge goals, ability goals, and literacy goals, respectively. The ability indicator point is to refine the large outcome goals and decompose them into small goals to enhance the correspondence between the goals and the project so as to facilitate teachers' teaching as well as students learning.
3. This stage is to adjust and reconstruct the teaching contents to form "project-based" course teaching contents, and the projects are integrated and summarized on the basis of the known outcome goals, realizing "project" to drive knowledge and "project" to link the whole course. "Project" connects the whole teaching content.

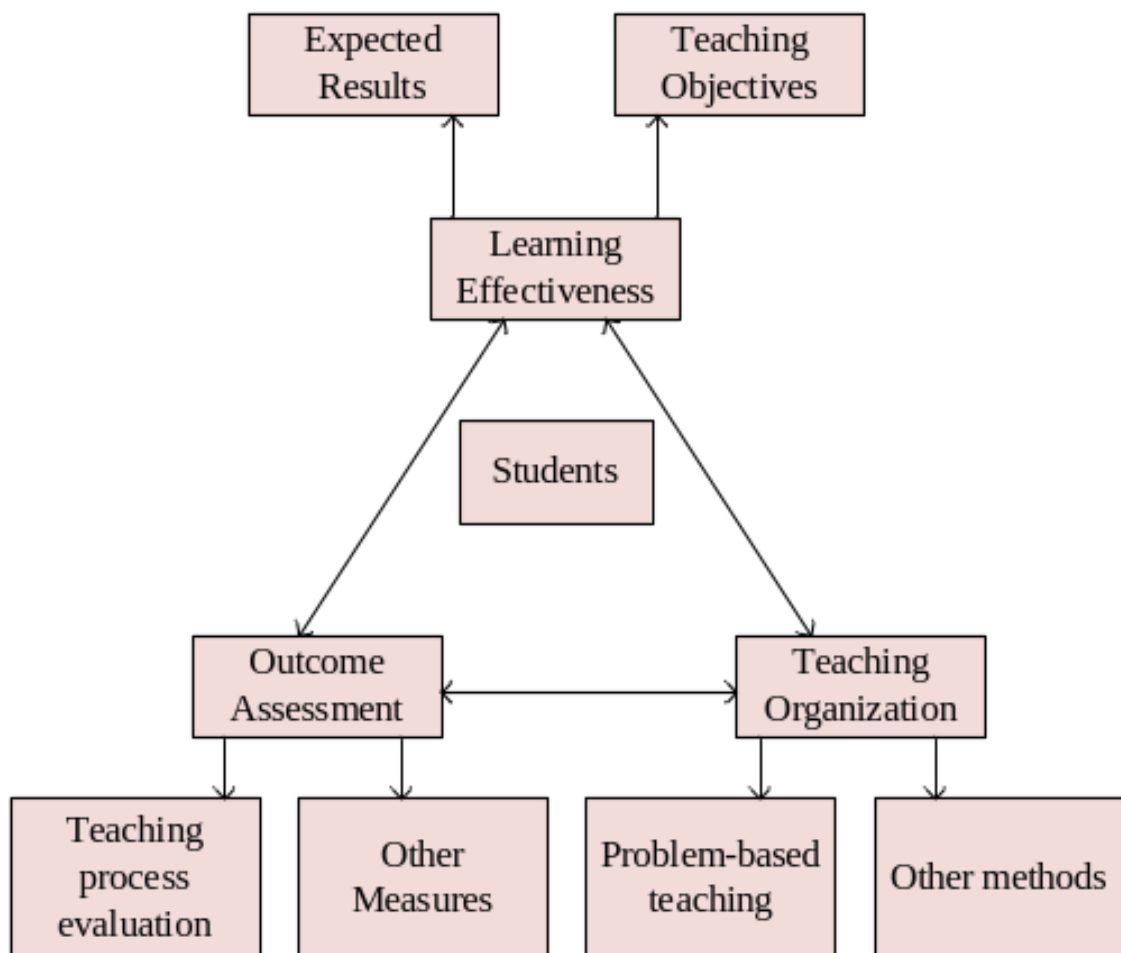


Figure 5: Teaching model based on OBE concept

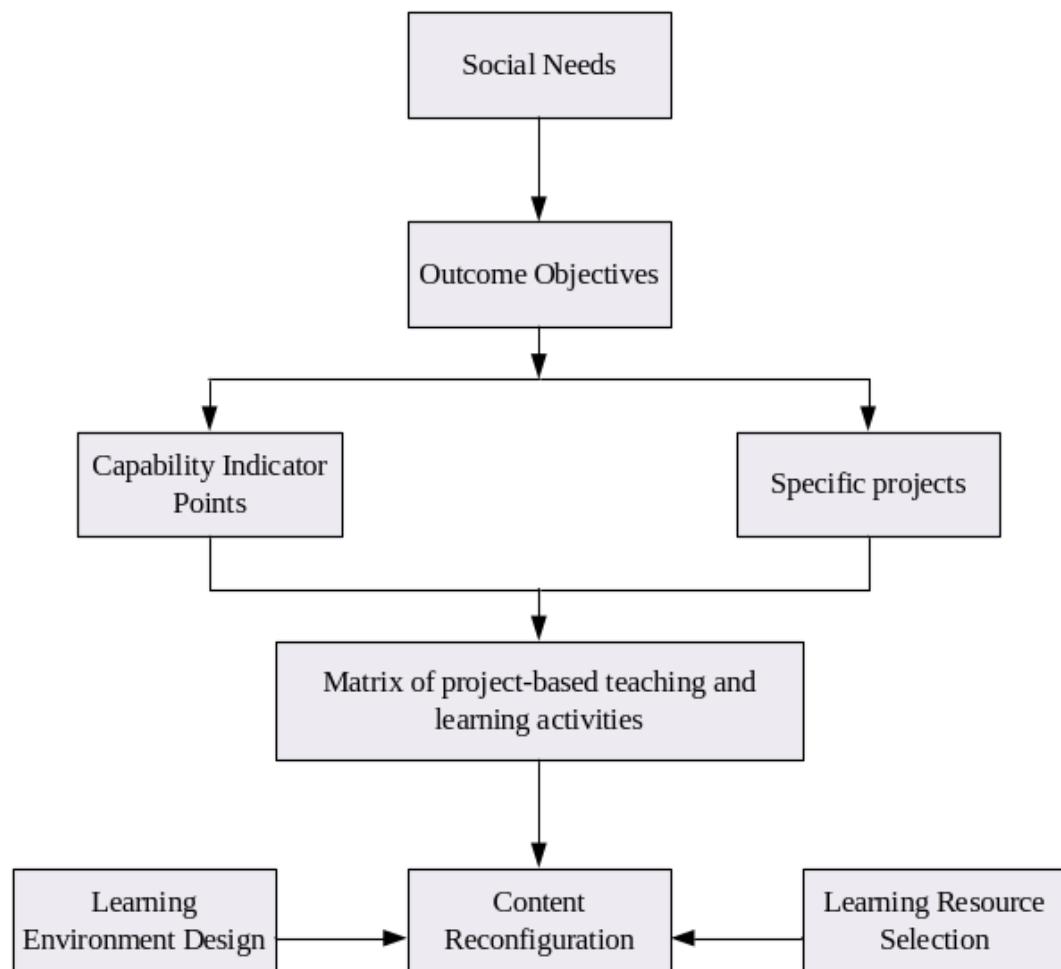


Figure 6: Instructional design based on the OBE concept

4. The project-based learning activity matrix is composed of specific projects and competency index points, which correspond to each other. The project-based learning activity matrix is shown in Table 1. Each project can contain multiple index points, and each index point has a corresponding project-based learning activity to undertake to ensure the integrity of the project and competency index points.

Table 1: Matrix of project-based learning activities

Correspondence	Project 1	Project 2	Project ...
A1	H		
A2		H	L
.....			L
B1	M		
B2			H

Where H is a high support indicator point, M is a medium support indicator point, L is a low support indicator point, and A1, B1, and C1 are specific capacity indicator points.

3.3.2. Realizing the learning output phase

The specific teaching process includes the integration of teaching resources through project teaching, breaking down the barriers between courses and specialties, improving the previous division of knowledge and skills, and finally realizing effective teaching.

3.3.3. Evaluating the learning output phase

The evaluation of the learning outputs phase is an important part of ensuring the integrity of instruction. The OBE theory has changed the summative assessment approach and rejected the achievement theory, hoping that students can achieve learning outcomes and master learning skills through a comprehensive and three-dimensional assessment and that students can reflect on their personal performance in the assessment and improve through reflection. It is hoped that students can reflect on their personal performance in the evaluation and make continuous progress in the reflection.

3.3.4. Using the learning output phase

After the completion of the course, students participate in work practice and observe their knowledge and competence based on the unit assessment results, which also serve as an important basis for verifying the effectiveness of the model in training human resources, thus helping the teaching model to continue to improve and refine.

4. Analysis of the Construction of a Public Teacher Training System by Empirical Modal Analysis under the OBE Concept

4.1. Construction of Curriculum System of Teacher Training Based on the OBE Concept

In the process of constructing the curriculum system of teacher training based on the OBE concept, it should be clear that the teaching of the curriculum should adhere to the center of students, pay attention to the dominant position of students in teaching, design the expected learning outcomes and design teaching objectives with students as the center, and then clarify the goal of talent training, configure course content, set course modules, and develop course teaching plans. The curriculum system of teacher training based on the OBE concept is shown in Figure 7.

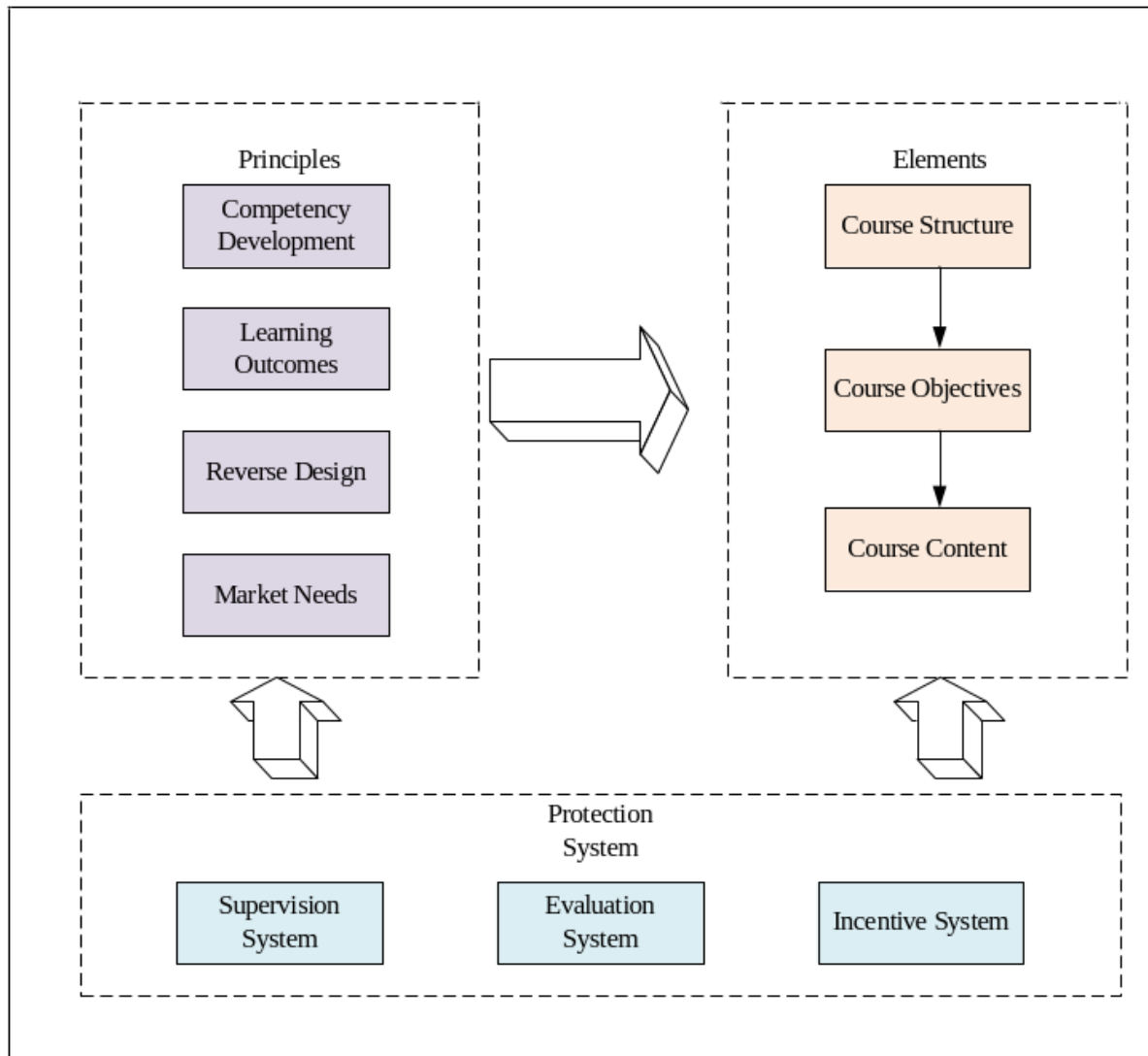


Figure 7: Curriculum system of teacher education based on the OBE concept

4.2. Analysis of Expected Learning Outcomes of Publicly Funded Teacher Trainees under the OBE Concept of Empirical Modal Analysis

4.2.1. Clarify the graduation requirements for publicly funded teacher trainees

Graduation requirements include the knowledge, skills and abilities that students have mastered through the study of the major and are specific standards for the indicators and learning outcomes that graduates should have and achieve at the time of graduation. The source and root of talent training goal determination are graduation requirements, and the two should echo each other. The graduation requirement is to explain what students can have, while the cultivation goal is to explain what students can do in society after passing the education and cultivation of the school, and what they have is the premise of what they can do.

The graduation requirements clearly show the knowledge requirements, ability requirements and quality requirements that students of this major should have after graduation, i.e., the learning outcomes that students can obtain upon graduation, which are used as the main learning directions for students' learning outcomes and the main points for the construction of curriculum system. The correspondence between the learning outcomes and graduation requirements of publicly funded teacher training students is shown in Table 2. The graduation requirements not only support the training goals but also must be coordinated with the goals of higher education, the demand for talents in the education industry and the students' own requirements for their personal career development. Publicly funded teacher-training students need to complete all the training requirements stipulated in the talent cultivation program, obtain at least the required total credits, and obtain a teacher qualification certificate, Putonghua certificate and computer certificate during their school years in order to meet the graduation requirements.

Table 2: Correspondence between grades and graduation requirements

Project	Graduation Requirements
Learning outcomes 1	Basic cultural knowledge
Learning outcomes 2	Professional theoretical knowledge
Learning outcomes 3	Practical operation ability
Learning outcomes 4	Collaboration and communication skills
Learning outcomes 5	Ability to learn and innovate
Learning outcomes 6	Teacher Professionalism

4.2.2. Clarify the competency indicators for publicly funded teacher trainees

By refining the graduation requirements for teacher training, they are broken down into specific indicator points. The curriculum relies on one-to-one correspondence with the indicator points for configuration, and the curriculum system is scientifically planned according to the interconnection of the curriculum competency indicators. The index points are the specific requirements that constitute the competency indexes, the competency indexes are the premise and foundation of the curriculum setting, and the curriculum set is the basic item of the curriculum system construction. Thus, it can be seen that the precise determination of the competency indexes can guarantee the correctness of the curriculum setting and the final guarantee of the scientific construction of the curriculum system. The correspondence between the graduation requirements and index points of publicly funded teacher training students is shown in Table 3.

4.3. The Effect of Constructing a Publicly Funded Teacher Training System by Empirical Modal Analysis under the OBE Concept

In the specific practice of constructing the curriculum system for publicly funded teacher training students based on the OBE concept, each course module of the publicly funded teacher training program is set according to the requirements of teaching positions and divided into five major course modules according to different natures: ideological and political course cluster, physical and mental health course cluster, theoretical knowledge course cluster, technical skills course cluster, and comprehensive ability

Table 3: Correspondence between graduation requirements and index points

Graduation requirements	Require-	Indicator Points
Cultural Basics		Ability to master basic knowledge of mathematics, language and English, ability to think independently, ability to analyze problems and solve them.
Professional knowledge	theoretical	Ability to master the theoretical knowledge of teaching
Practical skills		Ability to master teaching skills
Collaboration and communication skills		Good verbal skills, good flexibility and adaptability
Ability to learn and innovate		Ability to learn continuously and to provide personalized solutions to students
Professionalism of teachers		Possess good teaching ethics and have good psychological quality

course cluster. The relationship between the percentage of each subject and graduation requirements for publicly funded teacher training students is shown in Figure 8. The percentage of courses in teacher ethics ranged from 5% to 9%, physical education from 6% to 16%, mathematics from 8% to 12%, and computer fundamentals from 3% to 9%. The modules still refer to the content of the competency indicators for course content. The curriculum of each module is centered on predetermined learning outcomes to achieve the optimization of the curriculum modules and course settings.

The construction and implementation of the curriculum based on the OBE concept are closely focused on promoting the final learning outcomes of students, so students can clarify the learning content, learning methods and strategies, students' learning motivation is mobilized, students take achieving the expected learning outcomes as the goal, pay more attention to what knowledge and skills they have learned, have a strong interest in learning, and are very active in presenting their learning outcomes. Classroom participation increased, and the classroom atmosphere was more active, leading to improved student learning outcomes. The performance data of the publicly funded teacher training students by subject are shown in Figure 9. The performance points of class management, physical education and university language are mostly distributed in 3. The students' entrance education is good, and the performance points are mainly distributed in 4. In addition, teachers guide students to carry out effective learning, and teachers grasp the effectiveness of students' learning through timely feedback of teaching evaluation, and adjust teaching plans, teaching contents and teaching methods according to the feedback results so as to finally achieve the goal of talent cultivation and to improve the quality of talent cultivation.

5. Conclusion

The evaluation of the publicly funded teacher training system based on empirical modal analysis under the OBE concept should tend to be diverse. In order to better carry out the course teaching in the curriculum system constructed based on the OBE concept, teachers take into account students' learning interests and the multidimensionality of the course evaluation when conducting classroom teaching evaluation, which is significantly better than the single-dimensional evaluation of the old curriculum. An empirical analysis was conducted on the average subject performance of students in both classes under the old and new training systems. The average scores in the old training system and the average scores in the training system based on empirical modal analysis under the OBE concept were 72.41 and 88.72, respectively, with a large difference. The public teacher training system based on empirical modal analysis under the OBE concept has increased the proportion of practical courses in the training cluster and comprehensive ability

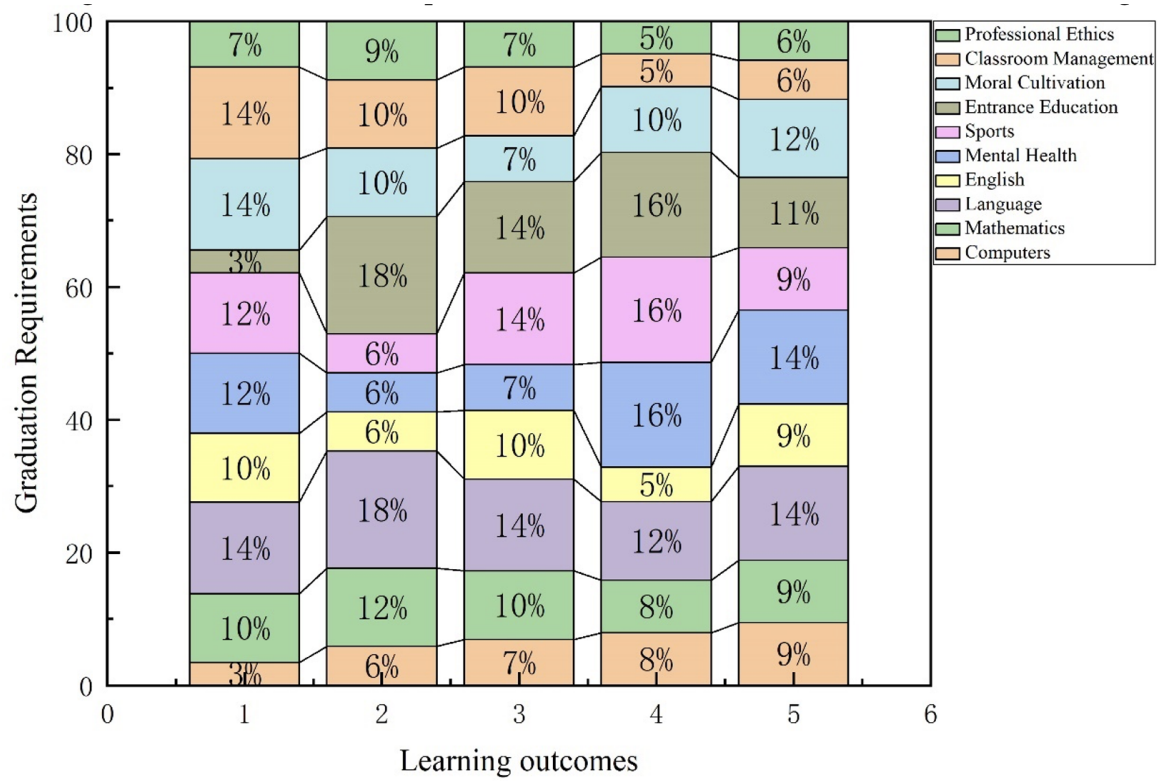


Figure 8: Relationship between subject ratios and graduation requirements

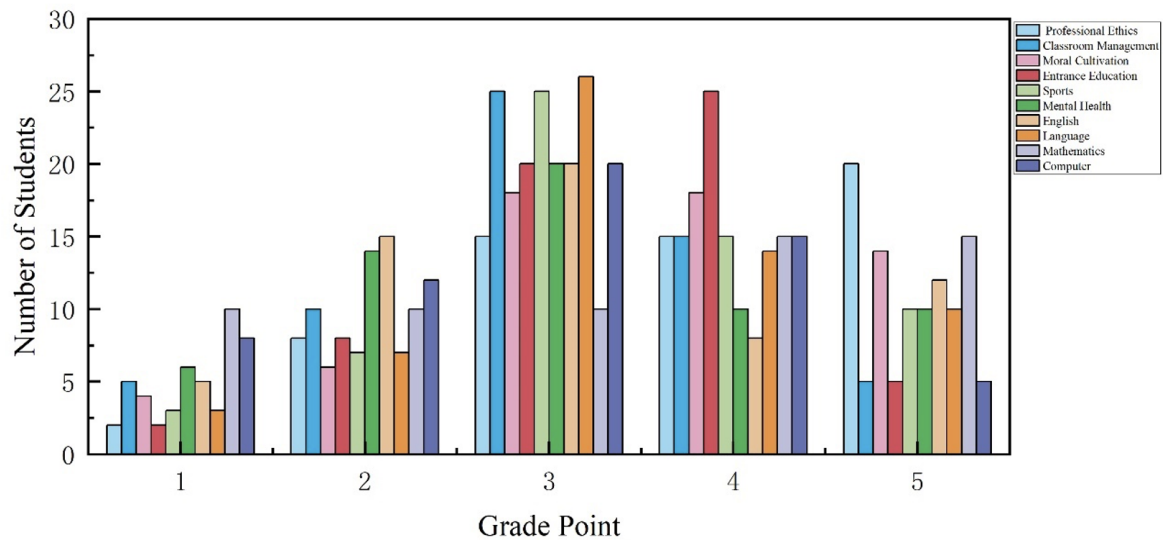


Figure 9: GPA data by subject for publicly funded teacher training students

training, and the learning outcomes are more explicit. Teachers help students achieve the expected learning outcomes and achieve the talent training goals more effectively through the practical operation and practical training settings of the practical courses.

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